

exercise solution 4.31

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R Markdown for the problem by Dhyey Mavani

```
# defining the branch function
branch <- function(n) {
  z <- c(1,rep(0,n))
  for (i in 2:(n+1)) {
    z[i] <- sum(sample(0:4, z[i-1], replace=T))
  }
  return (z)
}
```

```
# simulation 1 is about 3rd generation extinction
# simulation 2 is about the long term extinction
```

```
num_trials <- 70000
```

```
sim1 <- numeric(num_trials)
sim2 <- numeric(num_trials)
```

```
for (i in 1:num_trials) {
  out <- branch(10)
  sim1[i] <- if (out[4]==0) 1 else 0
  sim2[i] <- if (out[11] == 0) 1 else 0
}
```

```
mean(sim1) # this mean is P(Z_3 = 0)
```

```
## [1] 0.2662286
```

```
mean(sim2) # this mean signifies extinction probability e
```

```
## [1] 0.2752
```

```
pgf <- function(s) (1/5)*(1+s+s^2+s^3+s^4)
```

```
# this represents G_3(0) which should be indeed similar to P(Z_3 = 0)
pgf(pgf(pgf(0)))
```

```
## [1] 0.2663783
```